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# Indian Standard
# SPECIFICATION FOR COPPER WIRES FOR GENERAL ENGINEERING PURPOSES
## ( First Revision )

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MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 2 *September* 1981

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# SPECIFICATION FOR COPPER WIRES FOR GENERAL ENGINEERING PURPOSES
## *( First Revision )*

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# *Indian Standard*
# SPECIFICATION FOR COPPER WIRES FOR GENERAL ENGINEERING PURPOSES
## *( First Revision )*

## 0. FOREWORD

**0.1** This Indian Standard ( First Revision ) was adopted by the Indian Standards Institution on 29 May 1981, after the draft finalized by the Copper and Copper Alloys Sectional Committee had been approved by the Structural and Metals Division Council.

**0.2** Copper wires are used in a number of engineering applications in the form of rivets, bolts and nuts, wire cloth and nails. This standard was earlier published in 1957. In this revision the following changes have been made:

a) Scope of wire size has been extended;
b) Only grade 1 with minimum changes in the chemical composition has been retained;
c) For dimensions of wires, reference has been made to the relevant Indian standard; and
d) Tensile properties have been specified.

**0.3** For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

## 1. SCOPE

**1.1** This standard covers the requirements of copper wires for general engineering purposes.

## 2. TERMINOLOGY

**2.0** For the purpose of this standard, the following definition of wire in addition to those given in IS : 3288 ( Part I ) - 1981† shall apply.

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*Rules for rounding off numerical values ( *revised* ).

†Glossary of terms for copper and copper alloys: Part I Cast form and wrought form ( main types ) ( *second revision* ).

**2.1 Wire** — Rolled, extruded or drawn product of solid section of uniform cross section along its whole length and the distance between two parallel faces not exceeding 6 mm; may be supplied in straight length or in coils or on spools.

## 3. SUPPLY OF MATERIAL

**3.1** General requirements relating to the supply of material shall conform to IS : 1387-1967*.

## 4. CHEMICAL COMPOSITION

**4.1** Copper wires when analyzed in accordance with IS : 440-1964† shall conform to the requirements of IS : 191 (Part VIII) - 1980‡ as given in Table 1.

### TABLE 1 CHEMICAL COMPOSITION

| ELEMENT | PERCENT |
|---|---|
| Copper + Silver, *Min* | 99·80 |
| Phosphorus | 0·015 - 0·10 |
| Antimony, *Max* | 0·005 |
| Arsenic, *Max* | 0·05 |
| Bismuth, *Max* | 0·003 |
| Iron, *Max* | 0·03 |
| Lead, *Max* | 0·01 |
| Nickel, *Max* | 0·10 |
| Selenium + Tellurium, *Max* | 0·02 |
| Tellurium, *Max* | 0·01 |
| Tin, *Max* | 0·01 |
| Total of impurities excluding silver, nickel, arsenic and phosphorus, *Max* | 0·06 |

## 5. PHYSICAL PROPERTIES

**5.1 Tensile Test** — The copper wires above 1 mm diameter when tested in accordance with IS : 2656-1964§ shall have the tensile properties as given in Table 2.

### TABLE 2 TENSILE PROPERTIES

| TEMPER | TENSILE STRENGTH MPa, *Min* | ELONGATION PERCENT ON 100 mm GAUGE LENGTH, *Min* |
|---|---|---|
| O (Annealed) | 225 | 35 |
| HB (Half hard) | 280 | — |
| HD (Hard) | 340 | — |

NOTE — 1 MPa = 0·102 kgf/mm².

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*General requirements for the supply of metallurgical materials ( *first revision* ).

†Methods of chemical analysis of copper ( *revised* ).

‡Specification for copper: Part VIII Phosphorized copper ( DHP ) ( *third revision* ).

§Method for tensile testing of copper and copper alloy wire.

**5.2 Embrittlement Test** – When required by the purchaser, the test pieces may be tested in accordance with the method given in **5.2.1**.

**5.2.1** Test pieces of suitable length shall be made from wires selected as per **8.3** and exposed to an atmosphere of hydrogen for a period of 30 minutes at a temperature of 825 to 875°C after which they shall be cooled in the container itself ( out of contact with air ). Each test piece is to be bent steadily at right angle and flattened close. There shall be no sign of cracks or flaws on the pieces so tested.

## 6. FREEDOM FROM DEFECTS

**6.1** The wires shall be clean, smooth, uniform in diameter, and free from detrimental segregations, cracks, twists and kinks.

**6.2 Finish** — The wires shall be finished by such cold working and annealing operations as will produce the required temper and surface finish as agreed to between the purchaser and the manufacturer.

## 7. DIAMETERS AND TOLERANCES

**7.1** The diameters and tolerances on the diameters of wires shall be in accordance with IS : 9861-1981*.

## 8. SAMPLING AND RETEST

**8.1** In any consignment all the coils of wire of the same size, temper and manufactured by a single firm under essentially similar conditions of production shall be grouped together to constitute a lot.

**8.2** Unless otherwise decided by mutual agreement between the purchaser and the supplier, each coil of wire shall be examined from each lot for freedom from defects ( *see* **6** ) and for tolerances on diameters ( *see* **7** ). Any coil found defective in accordance with the provisions of **6** and **7** shall be rejected.

**8.3** Unless otherwise agreed by the supplier and the purchaser, either one test for chemical composition shall be conducted for each 50 kg or part thereof of wires in this lot or one test for 500 kg or part thereof of a lot comprising the same cast.

NOTE 1 — The material required for chemical analysis from each of the coils intended for testing shall be collected in accordance with IS : 1817-1961†.

NOTE 2 — When the size of the order does not permit grouping in the above quantities, the rate of testing shall be as agreed to between the purchaser and the supplier.

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*Dimensions for wrought copper and copper alloy wire for general engineering purposes.

†Methods of sampling non-ferrous metals for chemical analysis.

**8.3.1** If the results as obtained for each of the chemical characteristics satisfy the corresponding requirements under **4**, the lot shall be considered as conforming to the chemical requirements of this specification.

**8.3.2** If the test results fail to satisfy the requirements for any of the characteristics, two more tests for that characteristic shall be done on the sample in order to confirm that the analysis has been done properly. If both the test results satisfy the relevant requirements under **4** the lot shall be considered as conforming to the specification, otherwise not.

## 9. PACKING

**9.1** The wires shall be coiled carefully and each length of the wire shall be made up into a separate coil of mass up to 50 kg. The inner diameter of the coil shall be as agreed to between the supplier and the purchaser.

**9.2** The coils shall be suitably packed to avoid damage during transit.

## 10. MARKING

**10.1** Suitable metallic tags and labels with markings made on them to show the temper of the material in addition to the name of the manufacturer, mass, length and any such information required by the purchaser, shall be attached to each coil of the material.

**10.1.1** The coils of wire may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution ( Certification Marks ) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard, under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

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# AMENDMENT NO. 1 JUNE 2004
# TO
# IS 4412 : 1981 SPECIFICATION FOR COPPER WIRES FOR GENERAL ENGINEERING PURPOSES

***( First Revision )***

( *Page* 3, *clause* 2.0, *line* 2 ) — Substitute 'IS 3288 ( Part 3 ) : 1986†' *for* 'IS : 3288 ( Part 1 ) - 1981†'.

( *Page* 3, *footnote marked* '†' ) — Substitute the following for the existing footnote:

'†Glossary of terms relating to copper and copper alloys : Part 3 Wrought forms.'

( *Page* 4, *clause* 3.1, *line* 2 ) — Substitute 'IS 1387 : 1993*' *for* 'IS : 1387 - 1967*'.

( *Page* 4, *footnote marked* '*' ) — Substitute the following for the existing footnote:

'*General requirements for the supply of metallurgical materials (*second revision*).'

( *Page* 4, *clause* 5.1, *line* 2 ) — Substitute 'IS 1608 : 1995 §' *for* 'IS : 2656-1964§'.

( *Page* 4, *footnote marked* '§' ) — Substitute the following for the existing footnote:

'§Mechanical testing of metals — Tensile testing (*second revision*).'

( MTD 8 )

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